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THIS PUBLICATION GIVES INFORMATION on new developments of interest to agriculture based on the work done by scientists and agricultural field men of the du Pont Company and its subsidiary companies.

It also gives reports of results obtained with products developed by these companies in the field whether the tests are made by field men of the companies, by agricultural experiment stations or other bodies. Also data on certain work done by agricultural stations on their own account and other matters of interest in the agricultural field.

This issue contains:

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SEED TREATMENT IN DROUGHT STATES

IS A MATTER OF UTMOST IMPORTANCE

EDITOR'S NOTE:- An aftermath of the drought of last year is the serious situation in the matter of grain seed. This discussion by Dr. Haskell indicates means by which the present shortage of seed can in considerable measure be compensated for and growers saved heavy losses. The article is presented with the approval of Dr. C. W. Warburton, Director of Extension Work, U. S. Department of Agriculture.

Early last fall when the full force of the drought took effect, it became very evident that unless some extraordinary move was made to save grain seed much of the best seed in the more seriously affected States would be lost through feeding, milling, or processing. Accordingly, the United States Department of Agriculture, through the Agricultural Adjustment Administration, made available from drought relief funds $25,000,000 for the conservation of seed supplies in the drought area. A Seed Conservation Committee was set up within the Department to direct the work and a Seed Stocks Committee was placed in immediate charge with headquarters at Minneapolis.

As a result of these efforts about 20,000,000 bushels of the better adapted and superior varieties of wheat, oats, barley, flax, and grain sorghum have been conserved for this spring's planting. Through careful sampling and testing a very good quality of seed has been purchased and cleaned. By February 5, when the purchasing program was practically at an end, the following stocks had been acquired and stored in some 600 country elevators and a few larger terminal markets: wheat (hard spring) 5,590,804 bushels; durum wheat, 876,140 bushels; oats, 10,586,098 bushels; barley, 1,889,886; flax, 421,050; and sorghums, 591,050.

Distribution of Seed

The distribution of this seed is now in progress. Farmers who cannot obtain seed locally and who need the government seed have put in their orders through their local drought committees and county agents. The county orders are consolidated and sent to Minneapolis and from there the distribution is directed. Distribution to the farmers is being made through bonded elevators at country points.

Although this grain is superior in many respects, it needs treatment for the prevention of smuts and certain other seed-carried diseases. Any bulk lots of grain, composed of crops from many different farms, are bound to be somewhat smutty and need treatment. Microscopic examination of the cleaned grain samples and tests with the centrifuge at Minneapolis show that practically every lot of

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grain has smut in it and needs treating. Of the several grains the barley is the most uniformly as well as the heaviest smutted. Oats are also generally smutty, those from southern states being less smutty apparently than those from northern areas. The spring wheat and durum wheat are the least smutty of the three grains but all of them have some smut. Most of it is fairly light, however.

Seed Treatment Advocated

Because of the smuttiness of the grain for seed purposes, and because of possible danger of introducing new forms of disease, and also because of the fact that it is desirable that farmers secure the best possible returns from these emergency seed stocks, those in charge of the distribution program are encouraging treatment of this seed before it is sown. The possibility of treating all of this grain before it was distributed was seriously considered but found to be impracticable for several reasons. It was therefore decided that each State be encouraged to put on extension campaigns to bring about the treatment of as much of this grain as possible, as well as treatment of the other emergency seed supplies and local seed on farms.

To help the work along the Seed Conservation Committee has assigned temporary extension specialists in seed treatment in the States where most of the seed stocks will be used, namely, Minnesota, North Dakota, South Dakota, Nebraska and Montana. These specialists are working under the direction of the State Extension Directors and the State representatives in charge of emergency seed distribution.

One of the first activities in connection with the seed treatment work was to obtain the sentiment of farmers with regard to large-scale treatment of grain at the point of delivery. The most efficient way of treating grain that is shipped in is to apply the chemical disinfectant at the time the grain is delivered to the farmer. It was therefore decided to get the opinion of farmers as to whether or not they would be willing to pay up to 3 cents per bushel to have this treatment done for them. The cost of treating cannot be added directly to the cost of the grain but must be taken care of as a separate item, locally. Therefore, at the time the farmers put in their orders for seed in several of the States they were asked if they would like to have the seed treated provided it could be done in a satisfactory manner and at a cost to them of not more than 3 cents per bushel. The results of this canvass are not complete to date but they vary greatly depending on conditions. Growers in some localities are very much in favor of it and those in others not interested or prefer to treat at home.

Meetings Being Held

At the same time the State seed representatives and seed treatment specialists in the States are conducting meetings of farmers and meetings of elevator managers to talk these matters over and make arrangements to set up central seed treating stations. Other means

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and agencies such as publicity, bulletins, circular letters, etc., are being used to make farmers "seed treatment conscious" and to let them know how the job can be done. However, the most emphasis is being placed on personal interviews with county agents, county drought committees and local elevator men to place before them the facts concerning the importance of treating grain, especially this year, and to acquaint them with the latest and best materials and equipment that can be used.

Treating Made Easier

Centralized seed treatment is not a new activity. Scattered over the country are numerous companies that have been treating seed on a custom basis for several years. Most of these have used copper carbonate for wheat and formaldehyde for oats. During the last two years there has become available an organic mercury dust with ethyl mercury phosphate as its essential ingredient which can be used on barley as well as on the other two grains, and which because of certain other points in its favor, will make centralized, large-scale seed treatment simpler, easier and more popular.

Lost cost, satisfactory mechanic equipment for applying dust fungicides to seed grain rapidly an t the proper rate was not available last fall. There were two o three machines on the market for applying copper carbonate to wheat but nothing was available for applying accurate dosages of the organic mercury dusts. The batch mixer type was the only thing recommended but these are too slow, or if fast enough, too expensive, to fill all the needs of the present situation. Barrel mixers and the like are probably the best for small farm use but are out of the question for mass treatment. This lack of adequate machinery bids fair to hold up the seed treating program. To help out in the emergency the Division of Cereal Crops and Diseases, U. S. Bureau of Plant Industry, and the Bureau of Agricultural Engineering cooperated in the testing and devising of large scale dust treaters. During December 1934 and January 1935 rapid progress was made in the development of suitable equipment. At the same time at least two machinery companies and several individuals were experimenting. The University of Minnesota assisted with tests. The net result has been the development of economical and efficient large scale treaters. These are now being manufactured commercially and are now available for use in the drought area this spring. Many elevator managers have placed orders for machines and many more are setting up homemade equipment using plans furnished by the U. S. Department of Agriculture.

It is too early to venture a prediction as to the quantity of seed grain that will be treated this spring in the drought States, but it is safe to say that a considerable proportion of it will be treated and that more growers will have heard about and be interested in seed treatment than ever before.

SULFATED ALCOHOLS IN INSECTICIDES

INDICATE FAVORABLE CHARACTERISTICS

EDITOR'S NOTE:- In the preparation of this paper Dr. Cory and Dr. Langford have made a valuable contribution to data being developed on the place of the sulfated alcohols in relation to insecticides. The fundamental character of the research reported is such as to make this discussion a subject of wide interest among entomologists and others.

By Ernest N. Cory and George S. Langford*
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Sulfated alcohols, which have been developed in recent years as detergents, have properties which indicate that they may have uses in insect control work. Some of their characteristics are:

1. They are good wetting and sudsing agents.
2. They may be used in acid solutions.
3. Aqueous solutions are stable in alkalies.
4. They are compatible with hard water.

In consideration of these apparently favorable characteristics, preliminary studies have been made to ascertain their value as toxic agents for insects; as emulsifying agents for oils and other insecticides; as dispersing and carrying agents for certain insecticides, especially those that deteriorate in alkaline solutions; as wetting agents for alkaline as well as acid sprays; and as an aid in removal of the arsenical and lead residues on sprayed fruit.

The following sulfated alcohols** were used: Sodium lauryl sulfate, sodium octadecyl sulfate, sodium oleyl sulfate and sodium oleyl sulfate special. (1) The alcohols from which the compounds are derived are not pure. They are commercial types containing small amounts of other alcohols in the series. They have been standardized with sodium sulfate and the percentages of active material they contained was approximately as follows: Sodium lauryl sulfate 50%; sodium octadecyl sulfate 60%; sodium oleyl sulfate 28%; and sodium oleyl sulfate special 45%.

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Based on the percentage of active ingredients, preliminary tests, using grasshoppers as the test animals, showed that while all the materials have some toxicity, sodium lauryl sulfate and sodium oleyl sulfate special were the most toxic. These compared favorably with neutral potassium cocoanut fatty acid soap (Table 1). This same rating prevailed when emulsifying and wetting properties were considered.

Relative Toxicity

In order of toxicity, they are rated as follows: sodium lauryl sulfate, sodium oleyl sulfate special, soap, sodium oleyl sulfate, and octadecyl sulfate.

A spray of sodium lauryl sulfate at a dilution of 1% of the commercial product or 0.5% of active ingredient gave a kill on cabbage aphis varying from 92% to 98.2%, and on red spider the kill was 94%. At a dilution of 0.5% of the commercial or 0.25% of active ingredient, the kill was 71% for red spider and 20.5% for the cabbage aphis. Sodium oleyl sulfate special at 1% solution of the commercial product killed 92.1% of cabbage aphis.

Plants vary in their susceptibility to injury from sulfated alcohols. Snapdragons will withstand a 1% solution of the commercial product of sodium lauryl sulfate, while a solution containing more than .25% will injure chrysanthemums. Lantana is injured by .5% solution. Sodium oleyl sulfate special is slightly more injurious to foliage than sodium lauryl sulfate. These conditions indicate that sulfated alcohols cannot be used alone as insecticides until the factor or factors causing plant injury are discovered and reduced.

Use as Carriers

As a carrier for other insecticides, some of the sulfated alcohols appear to have potentialties. With nicotine sulfate 40% added at the rate of 1 part to 1000 parts, the following results were obtained with cabbage aphids:

Sodium oleyl sulfate .06% commercial product	- 25% kill
Sodium lauryl sulfate .06% commercial product	- 83% kill
Sodium oleyl sulfate special .06% commercial product	- 99.3% kill
Cocoanut fatty acid soap - 12% actual soap	- 66.1% kill
Nicotine only	- 17.5% kill

Preliminary tests with solutions containing .02% pyrethrins gave the following averaged kills on the Mexican mealy bug.

Sodium lauryl sulfate .25% of the commercial product	- 62.2% kill
Sodium lauryl sulfate .50% of the commercial product	- 100.0% kill
Sodium oleyl sulfate special .25% of the commercial product	- 57.0% kill

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Sodium oleyl sulfate special	.50% of the commercial product	- 100.0% kill
Sodium oleyl sulfate special (alone)	.5% of the commercial product	- 45.0% kill
Sodium lauryl sulfate (alone)	.25% of commercial product	- 0% kill
Sodium lauryl sulfate (alone)	.5% of commercial product	- 23.8% kill
Pyrethrins alone (.02% sol)		- 33.3% kill

Using grasshoppers dipped for ten seconds the addition of .01% pyrethrins to a .12% solution of sodium lauryl sulfate increased the average kill from either of the solutions alone from 10% to 66.6%. Using box elder bugs, dipped for five seconds, results as follows were obtained: Nicotine sulfate 1-500, 10% dead; sodium lauryl sulfate .25% (commercial product) 0% dead, and sodium lauryl sulfate .25% solution, plus nicotine sulfate 1-500, 75% dead.

A Mosquito Larvicide

As a mosquito larvicide both sodium lauryl sulfate and sodium oleyl sulfate special at a dilution of 0.5% of the active ingredients showed decided toxicity. Based on the time required to kill, the former was the more toxic. Sodium lauryl sulfate when used at the rate of 0.5% in an aqueous solution of pyrethrins at the rate of 1 part to 1 million and 1 part to 5 million, increased the speed of action nearly to four times in each dilution.

Sodium oleyl sulfate special in similar tests, in addition to aqueous solutions of pyrethrins up to 1 part to 1 million, showed an increase in the speed of action of approximately two and a half times. The sodium sulphate which occurs in the commercial products did not exhibit any toxicity up to 34 minutes.

These results summarize the data for 79 tests on Culex pipiens.

All of the materials in this work may be used as emulsifying agents for petroleum oils, pine oils and carbon bisulphide. Sodium lauryl sulfate and sodium oleyl sulfate special are far superior at ordinary temperatures to either of the other two materials in their emulsifying properties. Sodium oleyl sulfate is superior to sodium octadecyl sulfate. Both sodium lauryl sulfate and sodium oleyl sulfate special, on the basis of active ingredients, appear to be better than potassium cocoanut fatty acid soap. Stable emulsions of petroleum oils, both sulfonated and unsulfonated, ranging from kerosene fractions to viscosity of 110 Saybolt have been made to contain 83.3% oil. With sodium lauryl sulfate good emulsions can be made by using very small quantities, 100 mg. of the commercial product dissolved in 20 cc. of water will emulsify 100 cc. of oil. However, the emulsions are more easily made if 500 mg. or 1 gram are used with 20 cc. of water and 100 cc. of oil.

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For emulsifying carbon bisulphide sulfated alcohols appear to be far superior to soap. The breakdown that occurs in carbon bisulphide emulsion made with soap does not occur in the emulsions made with these materials. For carbon bisulphide the sodium oleyl sulfate special seems to be a better emulsifying agent than sodium lauryl sulfate.

Emulsifying Properties Rated

In general the emulsifying properties of the several compounds are rated as follows: Sodium lauryl sulfate, sodium oleyl sulfate special, sodium oleyl sulfate and sodium octadecyl sulfate.

As wetting agents sodium lauryl sulfate and sodium oleyl sulfate special seem to have possibilities. Excellent wetting is obtained on such waxy leaves as cabbage and kohlrabi with .06% concentration of the active ingredient of the materials. Table II gives the wetability of the various materials in comparison with soap.

A wetable sulfur is procured by mixing 1 part, by weight, of sodium lauryl sulfate with 100 parts, by weight, of sulfur. All of the sulfated alcohols appear to be compatible with lime sulfur and arsenate of lead.

With the advent of fruit washing to remove residues from sprayed fruit there has been a distinct need for some material for use in the acid solution to aid in removing residues. Because of its detergent qualities in cold water and its emulsifying properties sodium lauryl sulfate was tested for this purpose. One pound of the compound to 100 gallons of cold water containing 1% HCl acid removed from 86% to 89% of the lead and from 85% to 89% of the arsenic while the acid solution alone removed from 63% to 75% of the lead and from 63% to 70% of the arsenic.

* Joint authors.

** Samples and information were furnished by E. I. du Pont de Nemours & Company.

(1) Sodium oleyl sulfate and sodium oleyl sulfate special are both derived from oleyl alcohol, but sulfated under different conditions.

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TABLE I

COMPARATIVE TOXICITY OF SULFATED ALCOHOLS, SULFATED OLEYL ACETATE AND POTASSIUM COCOANUT FATTY ACID SOAP TO GRASSHOPPERS, *Melanoplus femur-rubrum* - TREATED BY DIPPING FOR FIFTEEN SECONDS.

Material	Percentage of Active Ingredient	Number Tests	Number Treated	Percentage Dead
Sodium Lauryl sulfate	1.00	1	10	100.00
	.50	4	40	95.00
	.25	5	50	90.00
Sodium oleyl sulfate	1.00	2	20	90.00
	.50	3	30	70.00
	.28	5	50	60.00
Octadecyl sulfate	1.00	1	11	90.00 +
	.60	7	70	34.20
	.30	3	30	3.30
Sodium oleyl sulfate special	1.00	1	10	100.00
	.50	2	20	80.00
	.25	2	20	65.00
Soap	1.00	5	50	92.00
	.50	4	40	82.50
	.25	2	20	60.00
Sodium sulfate	1.00	1	10	10.00
Water		5	50	2.00

TABLE II

RELATIVE PERCENTAGES OF THE UNDER SURFACE OF LEAVES OF KOHLRABI WETTED BY VARIOUS CONCENTRATIONS OF SULFATED ALCOHOLS AND SULFATED OLEYL ACETATE BY DIPPING.

Material	Active Ingredient Concentration of Solution			
	.25%	.12%	.06%	.03%
Sodium lauryl sulfate	100%	100%	75-90	25-60
Sodium oleyl sulfate	50 - 100	20-50	10-30	5-20
Sodium octadecyl sulfate	5 - 25	5-10	0- 5	0- 5
Sodium oleyl sulfate special	100	100	75-100	60-90
Soap (Potassium cocoanut fatty acid)	100	50-100	0-10	0-5
Water	0 - 5			

THE CHINCH BUG OUTBREAK IN THE CORN BELT

AND THE METHODS ADOPTED TO EFFECT CONTROL

EDITOR'S NOTE:- This article on what many consider the most threatening insect problem of the year was prepared by Dr. Annand expressly for use in the AGRICULTURAL NEWS LETTER. It has been made available through the courtesy of Mr. Lee A. Strong, Chief, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

Occasional outbreaks of chinch bugs of varying magnitude have occurred in the Middle Western States as long as corn has been grown. In only a few States - notably parts of Illinois, Missouri, and Kansas - can chinch bugs be expected to cause some damage every year. In a major portion of the area, outbreaks by chinch bugs are separated by periods of 5 to 10 years. Under conditions of unusually favorable weather, characterized by excessive drought and lack of precipitation during the spring months, extremely large populations may build up and spread over most of the Corn Belt States. Such an outbreak in the 90's, caused extremely serious losses. A repetition of the favorable climatic conditions resulted in an infestation during 1934 of the States of Kansas, Oklahoma, Nebraska, Iowa, Missouri, Illinois, Minnesota, Indiana, Ohio, and Michigan, which was probably even more severe than any previous infestation of which we have detailed information. This very severe infestation was met through a cooperative control campaign for which Congress appropriated $1,000,000. The Federal Government cooperated with the States in making available to farmers free creosote and other materials which could be utilized in maintaining effective barriers against the migration of these pests to corn. About 5 1/2 million gallons of creosote (Federal Specification TTW-556) were purchased by the Government, through the Department of Agriculture, and delivered to railway destination points within the States, and half a million gallons of gas tar from local plants was purchased for local distribution. The State organization was responsible for unloading, local distribution to farmers, local supervision, and determination of individual farmer's requirements. In addition to the material purchased by the Government, about 3 million gallons were purchased with State and private funds to complete the campaign. An estimated total of more than 53,000 miles of barrier were erected and maintained. In face of the extreme drought, State workers estimated a saving of more than $14,000,000 directly attributable to the chinch bug campaign. Funds under the appropriation became available June 8--too late for maximum effectiveness as the bugs had started migration in a considerable part of the infested area by the end of May. This necessitated extreme speed in the purchasing and deliveries of materials in order to stop

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the migration of the bugs which had already started. Loading of creosote was started immediately and 280,000 gallons were actually shipped by June 9, and by June 13 over 700,000 gallons per day were being delivered to the railroads for immediate shipment. Whole-hearted cooperation was obtained from the railroads and supplying companies, who assisted in every way possible in getting early deliveries to the anxious farmers who in some cases held their places in line awaiting the arrival of the cars for as long as 48 hours. Some creosote was even moved by passenger train to get maximum speed in delivery.

Second-brood Infestation

In spite of this extensive campaign which was waged against the first-brood bugs, many of the second-brood individuals matured in cornfields and in wild grasses, such as foxtail, and produced one of the heaviest overwintering populations on record. The infested area was extended during the fall by flights to new areas around the margin of the territory infested last year with the result that the situation for the coming season is even more serious than that of a year ago, both in extent and intensity of infestation, except for minor decreases in intensity which have occurred in certain States as a result of unfavorable climatic conditions last season.

Feeding Habits

The chinch bug is an insect whose feeding is confined almost entirely to grasses including the cultivated grains. It hibernates as an adult in many locations but primarily in grasses and around the margins of wood lots, in hedge rows, and similar locations. The mature, winged bugs migrate in the spring to small grains, when the air becomes warm enough, and appear to be particularly fond of barley. Except for the destruction of the bugs in their winter quarters by burning grasses and other cover, nothing can be done to prevent this movement by flight from the hibernating quarters to the small grains. Burning has very limited application. Community effort is required to make it useful and is accompanied by hazards to wood lots and buildings. It cannot be generally recommended. Neither has a method which is economical been developed for the control of these insects once they are in the corn or small grains. After leaving winter quarters, the adult bugs lay their eggs around the roots of the small grain plants and in cracks in the soil; the young nymphs hatch, and feed until the plants reach maturity or until they are dried up by drought, as occurred last year. With the disappearance of succulent food in small grain fields, which usually occurs before the bugs have obtained their wings, a migration on foot commences in search of succulent food material. Corn is very succulent and attractive to the bugs at this period and is one of the few generally grown grasses which offers suitable food material at migration time. Sudan grass, sorghums, and similar plants, belonging to the grass family, are also attacked.

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Control Methods

Prevention of injury to the corn crop is accomplished by the erection of barriers built by throwing a furrow between the corn plantings and small grains from which the bugs are coming. The furrow is turned toward the corn plants and carefully smoothed and a narrow line of creosote or other repellent material such as gas tar is placed just below the brow on the side towards the cornfield. Post holes are dug in the bottom of the furrow so that the chinch bugs, in following the creosote line along the steep side of the furrow, fall into the post hole where they may be destroyed by kerosene or by burning. Seven to eight bushels of chinch bugs were not infrequently obtained by this method on a half-mile barrier in a period of three weeks during the 1934 campaign. Recent experiments have been conducted particularly by workers in the States of Iowa and Illinois in an attempt to improve the effectiveness of the barrier and to make its maintenance less laborious. Paper cut in four-inch strips placed edgewise along the barrier and kept saturated with creosote has given encouraging results. Dust barriers are also occasionally used but they are much less effective than the chemical barriers. Any bugs which manage to get past the barrier line and into the corn or those that get into fields not protected by barriers are able to mature, develop wings, and distribute themselves by flight over the cornfields. Occasionally late small grains, such as oats, will harbour bugs which when mature may fly over the barriers to infest the corn. The second brood of chinch bugs is then produced in the corn or sorghum plantings. The adults of this brood may distribute themselves in the fall by flying to other corn or sorghum fields and to hibernation quarters.

Care in Planting

Careful arrangement of planting to avoid the placing of corn next to small grains will prevent some damage and will make the control of migrating bugs much easier. Such crops as soybeans, clover, beans, peas, alfalfa, sunflowers, flax, potatoes, and in fact all crops except members of the grass family are not susceptible to injury and may be planted between corn and small grains likely to be infested. An increase in the acreage of nonsusceptible crops and a reduction in the susceptible ones is desirable in heavily infested areas.

Present indications are that it will be necessary for the farmers in the Middle Western States to repeat the extensive campaign which was waged last year against these pests, either with or without Federal funds to assist them. There is always a possibility, however, that unfavorable spring weather conditions will result in epidemics of disease which may almost completely wipe out even high populations, and of severe beating rains which may close the soil cracks over the young bugs or the unhatched eggs and prevent the appearance of incipient outbreaks. Such possibility, however, cannot be depended upon to bring about control of these insects.

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THE RELATION BETWEEN THE EQUIVALENT ACIDITY OF SOURCES OF NITROGEN AND THEIR EFFICIENCY IN POTATO FERTILIZATION SUBJECT OF RESEARCH

EDITOR'S NOTE: - This timely and informative paper by Dr. Parker summarizes investigations carried on in connection with fertilizer materials. It presents data of especial value to those interested in potato production in Maine, Pennsylvania, Maryland, Virginia and North Carolina.

By F. W. Parker, Ammonia Department,
E. I. du Pont de Nemours & Company.

The influence of nitrogenous fertilizer, particularly ammonium sulfate and nitrate of soda, as a factor influencing their efficiency in potato fertilization has been discussed by Brown, Owen and Tobey (2) and by Martin (3). The data of Pierre (4) on the equivalent acidity of different sources of nitrogen and recently published results of experiments on sources of nitrogen for potato fertilizers (1) make possible a study of the relation between the equivalent acidity of various sources of nitrogen and returns secured in field experiments.

Brown, Houghland and Reid (1) give the results secured with various sources of nitrogen in potato fertilizer experiments in Maine, New York, Pennsylvania, Maryland, Virginia and North Carolina. The experiments included a comparison of the following sources of nitrogen. The equivalent acidity values indicated were taken or calculated from Pierre's (4) data.

Source of Nitrogen	Equivalent Acidity per unit N lbs. $CaCO_3$
Nitrate of soda	36 basic
Ammonium sulfate	107 acid
50% nitrate of soda, 50% ammonium sulfate	36
Ammonium nitrate	36
Urea	36
50% organics, 25% nitrate, 25% sulfate	30

In the experiments all of the nitrogen was applied as part of a complete fertilizer carrying from 4.0 to 6.0 per cent nitrogen. Since it was applied in the row before planting there was always a possibility of loss by leaching, particularly from nitrates, the only form of nitrogen that leaches readily. The experiments in Maine, New York, Maryland, Virginia and North Carolina were conducted on moderately to strongly acid soils such as are normally used for potatoes. The Pennsylvania experiments were on neutral or slightly acid soil and, therefore, are not included in Table 1 which summarizes the yield data.

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Table 1

Average Yield of Potatoes in Source of Nitrogen Experiments

No.	Location of Experiment	No. of Crops	Source of Nitrogen in Complete Fertilizer: Nitrate of Soda	Ammonium Sulfate	50% Nitrate 50% Sulfate	Ammonium Nitrate	Urea	50% Organic 50% Inorganic	No Fert.
1	Maine	6	279	290	296	311	313	306	190
2	New York	3	263	237	259	262	259	253	143
3	New York	2	250	255	277	276	267	300	202
4	Virginia	4	154	174	182	169	181	191	88
5	Maryland	7	93	114	111	-	134	126	36
6	N.C.	5	215	215	-	-	255	263	163
1-6	Av.yield	27	196	205	-	-	227	228	126
1-6	Av.increase		70	79	-	-	101	102	-
1-5	Av.yield	22	192	203	215	-	221	221	117
1-5	Av.increase		75	86	92	-	104	104	-
1-4	Av.yield	15	239	244	256	259	261	264	155
1-4	Av.increase		84	89	101	104	106	109	

The average results for experiments 1 to 6 show that nitrate of soda increased the yield 70 bushels; ammonium sulfate, 79 bushels; urea, 101; and the organic-inorganic mixture, 102 bushels. The relatively poor returns from nitrate of soda are probably due to loss by leaching. Brown, Owen and Tobey (2) show that in the Maine experiments nitrate of soda gives excellent results in dry years, but poor results in wet years. A significant feature of the results is that urea and the organic-inorganic mixture have essentially the same equivalent acidity and give similar increases in yield, 101 and 102 bushels respectively, an increase of 22 and 23 bushels over the ammonium sulfate plot.

Experiments 1 to 5, including 22 crops, had a plot receiving equivalent amounts of nitrogen in nitrate of soda and ammonium sulfate. In such a mixture the equivalent acidity per unit of nitrogen is only one-third that of ammonium sulfate and danger of loss by leaching is materially reduced as compared to nitrate of soda. The data show that the mixture was much better than either component used alone.

Ammonium nitrate was included in experiments 1 to 4 so a comparison of six different sources can be made. Nitrate of soda, basic but

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easily leached, produced an increase of 84 bushels. Ammonium sulfate, not readily leached but very acidic, produced an increase of 89 bushels. The nitrate sulfate mixture, and ammonium nitrate, slightly acidic and only one-half in a form easily leached, produced increases of 101 and 104 bushels respectively. Urea and the organic-inorganic mixture, slightly acidic and not readily leached, gave increases of 106 and 109 bushels.

Summary

The data show a good correlation between crop increase and the equivalent acidity of sources of nitrogen that do not leach readily when used on moderately to strongly acid soils. A water soluble organic, inorganic materials, and organic-inorganic mixtures of similar equivalent acidity per unit of nitrogen produced similar increases in the yield of potatoes. The results indicate that two important factors, (1) equivalent acidity per unit of nitrogen, and (2) susceptibility to leaching, determine the efficiency of most nitrogenous fertilizers. The low equivalent acidity of natural organics is probably one of the most important factors accounting for their popularity in regions of intensive fertilization. As respects the second factor, ease of leaching, nitrates are in one class and are easily leached. Ammonium sources, urea and natural organics are not readily leached from the soil.

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PONDS BLASTED WITH DYNAMITE SERVE DIFFERENT USEFUL PURPOSES ON FARM

EDITOR'S NOTE: - In this article, the third of a series, Mr. Livingston discusses the post-hole method of blasting deep ponds. In an early issue he will describe the methods now followed in cleaning out ditches and ponds.

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Agricultural Extension Section,
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Within the relatively small area of the average size farm there is not always found all the physical characteristics desired. It, therefore, is sometimes necessary to do a bit of engineering to make a farm an efficient and economical producing unit, or to otherwise improve it. For instance, it may be that a pond must be made.

The usefulness of ponds is, of course, rather generally recognized. It is a fact, however, that the drought of last year served to create more lively interest in ponds in some sections. It is frequently the case that a wet portion of a farm can be made to serve a useful purpose as the site of a duck pond, a fish pond or an ice pond. A pond for water storage or drainage is a necessity in many cases. To some extent ponds are made for irrigation use.

Blasting Deep Ponds

Deep ponds with a width up to 36 feet and a maximum depth of 12 feet, and of any required length can be made by blasting. What is called the post-hole method of loading is followed. It is so designated because the holes for loading the dynamite must be comparable in size to fence-post holes and, usually, a post-hole earth auger is used in making the holes. The reason for the diameter of the holes is that they must be sufficiently large to permit the loading of a bundle of cartridges of dynamite.

The load is placed at one-half to two-thirds of the desired depth of the pond. A single line of holes -- in the center of the area to be blasted -- are put down. This plan of loading usually gives a pond with a bottom width equal to the depth and a top width approximately three times the depth.

In the case of a pond of 6 feet or more in depth, experience indicates that the recommended charges, spaced at a considerable distance apart, and fired -- either by propagation or electrically -- will throw out a greater yardage of material than will column-loaded holes of lighter loading placed closer together.

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The post-hole method has been used with success with loads as small as six sticks per hole spaced three feet apart. The specifications shown below give details on loads of from six sticks to one hundred sticks per hole, with from three to six feet distance between the holes. The maximum size of ditch given in the table shows a top width of thrity-six feet and a depth of twelve feet.

While the table is a very good starting point, a test shot is always advised before loading any great number of holes.

The quantity of dynamite to be placed in each hole in the test shot can be determined by the cubic yards of material that each hole is expected to remove. The basis of calculation is one cubic yard per pound of du Pont Ditching Dynamite.

Specifications for Post-Hole Loading

Number of sticks per hole	6	10	20	30	50	100
Number of pounds per hole.....	3	5	10	15	25	50
Distance between holes --feet...	3	3½	4	4½	5	6
Depth at center --feet.....	4	5	6	7	8½	12
Bottom width of pond --feet.....	4	5	6	7	8½	12
Top width of pond --feet.....12		15	18	21	25½	36
Depth of load (2/3 center-line depth of pond) --feet.....	2 2/3	3 1/3	4	4 2/3	5 2/3	8
Diameter of post hole --inches..	4	4	6	6	8	8
Dynamite per rod --pounds.....16½		23½	24½	54¾	82½	138
Materials moved per rod--cu.yds.19		30.6	44	60	88	176

Note: Cartridges, or sticks, are 1¼" x 8"

Blasting Methods

As is generally known, it is necessary that the ground be sufficiently wet to carry the "explosion wave" where blasting is done by propagation. It is also known that but a single cartridge in but one of the holes is primed. Priming may be done with a blasting cap and fuse, or with an electric blasting cap. The primed hole should be the last one loaded.

For blasting in dry earth or that which is merely moist, it is necessary to use the electric method. In doing this, a single stick to each hole is primed with an electric blasting cap. The caps are wired in series and all fired at one time by means of an electric blasting machine.

It is highly important that all holes be tamped -- filled up -- after loading. Either earth or water will do. Where the ground is wet, frequently the holes fill with water, but if they do not, water should be poured in or earth put in and packed firmly.

Users of dynamite should understand safety rules, and observe them strictly.

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